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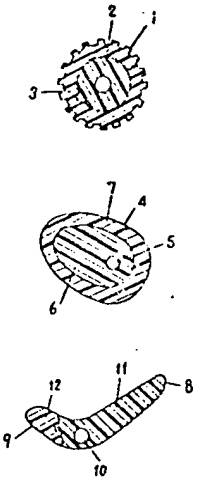
Mfg. mechanical parts from moulded polymers - formed in two stages from materials with different heat shrinkage

Mechanical components can be produced from a first moulded part of a resin material having a small percent of heat shrinkage and a second moulded part of a resin material having a percent of heat shrinkage larger than that of the first moulded part by integrating both parts during the heat shrinking step of the first moulded part.

Both parts are strongly bonded using the difference in heat shrinkage and the procn. time is reduced. The prods. are e.g. gears, cams, levers etc. requiring high abrasion resistance, friction properties, rigidness etc.(3pp119)

A(11-B2E, 11-C1C, 12-H3).

195



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⑭樹脂製機構要素部品の製造方法

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明　細　書

1、発明の名称

樹脂製機構要素部品の製造方法

2、特許請求の範囲

熱収縮率の小さい樹脂材料からなる第1成形部と、上記第1成形部より熱収縮率が大きい樹脂材料からなる第2成形部とから形成され、上記第1成形部の成形時の熱収縮過程中に同第1成形部に対し第2成形部を一体成形することを特徴とする樹脂製機構要素部品の製造方法。

3、発明の詳細な説明

本発明は特性の異なる樹脂材料にて形成された2種以上の成形部を各樹脂材料の熱収縮率の差を利用して強固に固着させ、用途に適した樹脂製機構要素部品を提供するとともに、製造時間の短縮を図ることを目的とするものである。

従来樹脂材料を使用した歯車、カム、レバー等の機構要素部品は単一材質の熱可塑性樹脂を用いて金型により成形されていた。一方、例えば歯車，カム，レバー類に要求される特性としては、当接部の耐摩耗性，摩擦特性，硬度等があり、これ等の特性は歯車，カム，レバー類を構成する材質によるところが大きい。従って耐摩擦、摩耗については、二硫化モリブデン，カーボン，弗素樹脂等の充填材を樹脂成形材料に添加した材料を使用して摩擦係数を小さくし、また作動時の騒音についてはポリウレタン軟質材を使用する試みがなされている。しかし上記材料は高価であると同時に歯車，カム，レバー類を上記のうちの一材質で成形した場合、強度的に問題がおきることが多い。これは摩擦，摩耗特性，騒音特性と、剛性などの機械的特性とが相反しているからである。したがって単一材質による成形品においては、耐摩耗特性摩擦特性に優れた樹脂成形材料はコストが高く、歯車，カム，レバー類の材料費が高価となる欠点また、耐摩耗特性，摩擦特性，騒音特性と剛性等機械的強度を兼ね備えた樹脂材料がなく、歯車，カム，レバーの特性もすべてを満足したものができない欠点、および、歯車，カム，レバーの当接部で必要とされる特性と軸嵌合部やレバー操作部

PTO 00-4158

Japanese Kokai Patent Application
No. Sho 55[1980]-257

MANUFACTURING METHOD FOR MECHANICAL ELEMENTAL COMPONENTS MADE OF RESIN

Tatsushi Yasuda et al.

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MANUFACTURING METHOD FOR MECHANICAL ELEMENTAL COMPONENTS MADE OF RESIN

[Jyushi sei kikou youso buhin no seizo houhou]

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[There are no amendments to this patent.]

Claim

A manufacturing method for mechanical components made of resin characterized by being formed of a primary molded part, which is made of a resin material with small heat shrinkage, and a secondary molded part, which is made of resin material with heat shrinkage larger than that of the aforementioned primary molded part, and by integrally molding the secondary molded part to the aforementioned primary molded part during the heat shrinking process at the molding of said primary molded part.

Detailed explanation of the invention

The aim of this invention is to offer mechanical components that are made of resin suitable for application by strongly adhering molded parts of 2 or more kinds formed of resin materials with difference characteristics together through the utilization of differences in heat shrinkage of each resin material, and to attempt to shorten the manufacturing time as well.

Mechanical components, such as gears, cams, and levers, for example, that use resin material were conventionally molded using a single thermoplastic resin material and a metallic mold. On the other hand, characteristics that are required in gears, cams, and levers, for example, include abrasion resistance, friction properties, and rigidity, for example, of the contacting part, and these properties greatly depend on the material which makes up the gears, cams, and levers. Accordingly, concerning abrasion resistance and friction, attempts have been made to reduce the coefficient of friction by using material into which a filler, such as molybdenum disulfide, carbon, and fluororesin, for example, is added to a resin molding material. Concerning noise during operation, the use of soft polyurethane material has been attempted. However, the aforementioned materials are expensive, and at the same time the issue of strength often occurs when gears, cams, levers are molded using one of the aforementioned materials. This is because the friction and abrasion properties, noise properties, and mechanical properties, such as the rigidity, for example, are contrary to each other. Accordingly, a molded product using a single material had a disadvantage in which the cost of resin molding materials having excellent abrasion resistance and friction properties was high, and the material cost of gears, cams, and levers was high; an advantage in which there was no resin material that had abrasion resistance, friction properties, noise properties, and mechanical strength, such as rigidity, for example, all together, and products that satisfied all of the properties of gears, cams, and levers, for example, could not be obtained. Also the coverage by shape was limited even though different characteristics were required at the contacting areas of gears, cams, and levers, and at the axial engagement part and the lever operating part in many products; and a disadvantage in which the required accuracy could not be obtained at the shrinkage rate of the conventional resin materials even though dimensional accuracy was required in precision gears, cams, and levers, for example.

The strength at the bonding areas decreased, and the assembling number increased in those in which 2 or more molded pieces were assembled through a measure like bonding, for example, for solving the aforementioned problems, and it had a disadvantage of a high cost.

This invention offers high quality mechanical components that are made of resin at a low cost, in which the aforementioned conventional problems are improved, and Application Example 1 of this invention will be explained with Figures 1 and 2.

In the figures, (1) is a gear, (2) is a primary molded part made of ABS resin, and (3) is a secondary molded part made of polyurethane resin. A publicly known 2-color molding method is used as the molding method. First, ABS resin is used, a primary molded part (2) is molded by a primary cavity, and a secondary molded part (3) is afterwards molded around the primary molded part by a secondary cavity. The aforementioned molding is performed in a relatively short period of time after molding the primary molded part (2), which is during the time up to the completion of cooling of the aforementioned primary molded part (2), which is until the complete hardening of the surface of the primary molded part (2).

Accordingly, it has the advantage of the ability of the overall molding time being shortened because molding the aforementioned secondary molded part can be attained at an early stage. Also, the secondary molded part (3) is molded before the surface of the primary molded part hardens. Therefore, the boundary area will be in a slightly fused state, and the secondary molded part (3) strongly fuses into the primary molded part (2) from the difference in heat shrinkage between both molded areas and they are closely adhered, and they can be strongly pressure integrated together through simple cooling without using a bonding material, for example. The gear (1), which is manufactured in this manner, uses a polyurethane resin at the area where teeth are formed (rolling surface), and the problem of low noise during operation is sufficiently satisfied. On the other hand, the problem of limited rigidity possessed by the urethane resin is compensated by the ABS resin, and a temporary deformation does not even occur by the load during the operational rotation when used as a gear. ABS resin also has the advantage of obtaining dimensional accuracy of the outer dimension when compared to a gear by only a polyurethane resin with a large molding shrinkage because it has a smaller heat shrinkage than polyurethane resin, for example.

Next, a cam in Application Example 2 will be explained with Figure 3.

(4) is a cam, which was conventionally molded utilizing a nylon 66 resin containing molybdenum sulfide. The reason for using this nylon 66 resin containing molybdenum sulfide is because the nylon 66 resin containing molybdenum sulfide has the advantages of a small coefficient of dynamic friction and coefficient of static friction, small strength required for the operation of the cam, and small abrasion at the contacting area (the peripheral area of the cam). However, nylon resin has a high rate of absorption and a large dimensional change as the result of the adsorption of water. Moreover, it easily slips because it contains molybdenum sulfide, therefore, it has the disadvantage of a metallic shaft easily slacking when pressure fit into a shaft hole (5), and another disadvantage, in which the nylon 66 resin is more expensive than resins for general use.

In this application example, the cam (4) has a double structure, in which the primary molded part (6) is made of polyacetal resin and the secondary molded part (7) is made of nylon

66 resin containing molybdenum sulfide, and it was formed by the two-color molding method like the first aforementioned application example. The abrasion at the outer peripheral area of the cam can be made small by the nylon 66 resin containing molybdenum sulfide, and the shaft does not loosen at the inner area because of the polyacetal resin. Also, the primary molded part (6) and the secondary molded part (7) are strongly connected together by the difference in shrinkage.

Next, Application Example 3 of this invention will be explained with Figure 4.

In the figure, (8) is a lever, which conventionally was molded by a polyacetal resin containing Teflon. The reason for using a polyacetal resin containing fluororesin was to consider the ease of slippage and abrasion resistance of the sliding part (9). However, there was no problem with ease of slippage and abrasion resistance at the contacting area, but it had the disadvantage of the entire lever deforming because the molding material had a small rigidity when the lever was operating at an axial area (10) as the supporting point.

In this application example, the primary molded part (11) is made of polyacetal resin containing glass fibers, and at the same time the sliding part (9) is formed as the secondary molded part and this secondary molded part (12) is made of polyacetal resin containing fluororesin so that [the lever] possesses the advantages of both molding materials. The bonding between both molding materials can also be integrated through the conventional two-color forming technique without using a bonding material, for example, and a lever can be made with a reduced number of processes.

In the aforementioned 3 application examples, the primary molded part was respectively formed of ABS resin, polyacetal resin, and glass fiber containing polyacetal resin. However, what is required between the resins which make up the primary molded part and the secondary molded part is pressure adhesion between both molded parts during cooling when they are made of materials having different heat shrinkages, and proper materials can be freely selected according to the application.

The table below shows the molding materials that have such a relationship.

① 第1成形部	② 第 2 成 形 部
③ ＡＢＳ樹脂	ポリプロピレン樹脂，ポリアセタール樹脂，ポリアミド樹脂，ポリウレタン樹脂，ＥＶＡ樹脂，充填材含有ポリアシド樹脂④
⑤ 充填材含有ＡＢＳ樹脂	上欄樹脂及びノリル樹脂，ポリカーボネート樹脂，充填材含有ポリアセタール樹脂，ＡＢＳ樹脂⑥
⑦ ポリアセタール樹脂	充填材含有ポリアミド樹脂，ポリアミド樹脂，充填材含有ポリアセタール樹脂⑧
⑨ 充填材含有ポリアセタール樹脂	充填材含有ポリアミド樹脂，充填材含有ポリアセタール樹脂，ポリアセタール樹脂，ポリプロピレン樹脂，ポリアミド樹脂，ポリウレタン樹脂，ＥＶＡ樹脂⑩

Key: 1 Primary molded part
2 Secondary molded part
3 ABS resin
4 Polypropylene resin, polyacetal resin, polyamide resin, polyurethane resin, EVA resin, and filler containing polyamide resin
5 Filler containing ABS resin
6 The resins in the upper column and nonylic resin, polycarbonate resin, filler containing polyacetal resin, and ABS resin
7 Polyacetal resin
8 Filler containing polyamide resin, polyamide resin, and filler containing polyacetal resin
9 Filler containing polyacetal resin
10 Filler containing polyamide resin, filler containing polyacetal resin, polyacetal resin, polypropylene resin, polyamide resin, polyurethane resin, and EVA resin

As clearly indicated in the explanation above, in the manufacturing method for mechanical components made of resin in this invention, [a product] is formed of the primary molded part, which is made of a resin material with relatively small heat shrinkage, and the secondary molded part, which is made of resin having larger heat shrinkage than that of the aforementioned primary molded part, and the aforementioned secondary part is held and integrated to the aforementioned primary molded part by the difference in heat shrinkage at the time of molding. Therefore, the aforementioned primary molded part and the secondary molded part strongly adhere to each other. Moreover, manufacturing is easier when compared to those in which both adhere to each other using a bonding agent, for example, and it displays the effect of a shortened molding time.

It also has the effect of displaying excellent performance as well as function, for example, according to the application and shape of the mechanical component by selecting a variety of resin materials for forming the primary molded part and the secondary molded part.

Brief description of the figures

Figure 1 is a front view diagram of a gear in an application example of this invention. Figure 2 is a cross-sectional diagram of the same gear. Figure 3 is a cross-sectional diagram of a cam in another application example of this invention. Figure 4 is a cross-sectional diagram of a lever in another application example.

2, 6, 11…Primary molded part, 3, 7, 12…Secondary molded part.

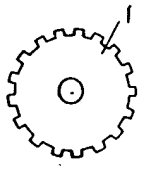

Figure 1

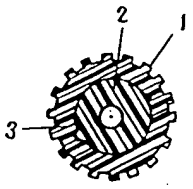

Figure 2

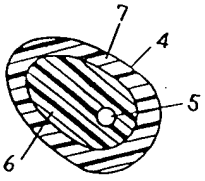

Figure 3